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ABSTRACT

The paper identifies a paradigm shift in research on teaching effectiveness from the process-product approach to explanations from cognitive psychology related to mediating variables which intervene between teacher behavior and pupil performance. Implications of this paradigm shift for research on the effectiveness of teachers of deaf students are drawn. Research on predictors of student outcomes with deaf students has tended to focus on background characteristics of students or on the effects of school placement in a very superficial way. Few studies have investigated the mediating variables between teachers and their hearing impaired students. A set of recommendations linking research on teacher effectiveness with the cognitive psychology framework in the context of deafness education is offered. The document notes the importance of providing feedback to teachers about their students' behavior and thinking in improving teaching outcomes. Researchable topics related to student and teacher thought processes such as student and teacher expectations, attention, motivation, memory, comprehension and knowledge acquisition, learning strategies, and metacognitive processes are identified. Modifications necessary for dealing with a deaf population are addressed for describing the teaching-learning process from the cognitive perspective. (Author/DB)

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IMPLICATIONS FOR TEACHER EFFECTIVENESS RESEARCH IN DEAF EDUCATION FROM THE COGNITIVE PARADIGM

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Abstract

Shulman (1986) identified the process-product research model as the most vigorous and productive of the programs of research on teaching effectiveness during the past decade. However, he noted that the process-product approach seems to be "losing intellectual vigor within the research community" (p. 12). Although relationships have been demonstrated between particular teacher behaviors and student performance, what tends to remain unexplained is why particular combinations of teacher behaviors lead to gains and others do not. This limitation imposed by the atheoretical process-product approach has led to increased interest in qualitative research methods that yield explanations derived from cognitive psychology related to mediating variables that intervene between teacher behavior and pupil performance (Brophy & Good, 1986); Evertson & Green, 1986; Shavelson, 1988; Shulman, 1986; Weinstein & Mayer, 1986; Wittrock, 1986).

The purpose of this paper is to review the implications of this paradigmatic shift for research on the effectiveness of teachers of deaf students. Most of the literature on teacher effectiveness has been done with normally hearing populations. Research on predictors of student outcomes with deaf students has tended to focus on the background characteristics of students or on the effects of school placement in a very superficial way (Mertens, in press). While some studies addressing interaction in the classrooms with hearing-impaired students do exist (Erting, 1982; Johnson & Erting, 1984; Kluwin, 1983; Mather, 1986; Supalla, 1986), few studies have investigated the mediating variables between teachers and their hearing-impaired students.

The outcome of this research is a set of recommendations linking research on teacher effectiveness with the cognitive psychology framework in the context of deafness education. The importance of this work is underscored by the suggestion by leading educational researchers that providing feedback to teachers about their students' behavior and thinking may well be the avenue to true improvement in teaching outcomes (Brophy & Good, 1986; Cazden, 1986; Shulman, 1986).

The research examines researchable topics related to student and teacher thought processes such as student and teacher expectations, attention, motivation, memory, comprehension and knowledge acquisition, learning strategies, and metacognitive processes. Modifications necessary for dealing with a deaf population are addressed for describing the teaching-learning process from the cognitive perspective.

Introduction

Leaders in the field of teacher education have recognized a shift in the image of the teacher to that of "thoughtful professional" or "reflective thinker" (Carnegie Commission Task Force, 1986; the Holmes Group, 1986; Wittrock, 1986). Along with this shift in image of the teacher, has come a shift in the

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research paradigm used to investigate teacher effectiveness (Peterson, 1988; Shavelson, 1988). For the past decade, the most vigorous program of research on teaching has been the process-product model of research (Shulman, 1986). However, the emerging image of the teacher as a thoughtful professional suggests a need for researchers to use alternative approaches to studying teacher effectiveness. One of the emerging approaches to research on teaching is the cognitive paradigm which allows researchers to study teachers' and students' cognitions in addition to teacher behavior, student behavior, and student achievement (Peterson, 1988).

The purpose of the present paper is to examine the implications of the cognitive paradigm shift for research in teacher effectiveness in deaf education. First, an overview from an historical perspective of the paradigm shift from the process-product model to the cognitive model is presented. Second, a conceptual framework within the cognitive model is discussed that examines the effect of paradigmatic choice in terms of definition of researchable topics and appropriate methodologies. Third, variables in deafness research that impact on the transfer of the cognitive model to teacher effectiveness in deaf education are discussed. Finally, the paper concludes by suggesting ideas for future thinking and research on teacher and student cognitions as mediators of teacher effectiveness.

Historical Overview of Paradigm Shift

In the process-product research model, investigators attempt to correlate teaching behaviors with student outcomes (Shulman, 1986). Thus, effective teaching was defined through an act of synthesis based on little evidence that any observed teacher had ever performed that collective pattern of the composite in the classroom. Then, when field experiments were completed, teachers who had been trained using the composites typically produced higher achievement gains among their students. However, it was typically found that the teachers in the experimental treatment did not always engage in the "desired" behaviors, and not all the trained behaviors continued to correlate with achievement. Researchers were led to

conclude that not all the elements in the composite were needed for effective performance. Because of the atheoretical nature of the process-product approach, they were unable to explain why particular combinations of behaviors led to gains and others did not. For this reason, the process-product model is "losing intellectual vigor within the research community" (Shulman, 1986, p. 12), and researchers have shifted to the cognitive model in order to examine the mediators of learning between teacher behavior and student performance.

Conceptual Framework for the Cognitive Model

The cognitive approach to learning seeks to understand how incoming information is processed and structured in memory (Farnham-Diggory, 1977). The learner is viewed in an active way, and learning depends jointly on what information is presented and on how the learner processes that information. Weinstein and Mayer (1986) identified a framework for describing the teaching-learning process from the cognitive perspective that included teacher characteristics (what the teacher knows), learner characteristics (what the learner knows), teaching strategy (what the teacher does during teaching), learning strategy (what the learner does during learning), encoding process (how the information is processed), learning outcome (what is learned), and performance (how learning is evaluated).

Peterson (1988) suggested that the model must also acknowledge the impact of the subject-matter content in work on teacher and student cognitions. She recommends including both general and content-specific categories of "cognitional" and "meta-cognitional" knowledge for both classroom learning and teaching. In other words, in order to learn effectively in a classroom, students need to have both general knowledge strategies for learning and acquiring information during classroom instruction, and content-specific knowledge of strategies that enable them to learn the specific subject-matter content. At the meta-cognitional level, learners have a self-awareness of both the general and content-specific cognitive processes and strategies for learning and acquiring information in a classroom. Teachers must be aware of

what their students already know at all levels of learning and how to facilitate their use of effective learning strategies through use of effective teaching strategies.

Definition of Researchable Topics

Within the cognitive model, both teachers' and students' thinking and cognitions are important objects of study for researchers on teaching (Peterson, 1988). Wittrock (1986) identified six topics that relate to student mediation of classroom events: perceptions and expectations, attention, learning and memory, comprehension, and learning strategies and meta-cognitive strategies. The relevance of the paradigm of choice to the definition of researchable topics can be illustrated by contrasting the approach of the process-product model and the cognitive model for the first topic, i.e., perceptions and expectations.

It has often been reported in the literature that the presence of high teacher expectations is a predictor of increased academic achievement; however, sometimes the results of process-product studies support this hypothesis and sometimes they do not (Wittrock, 1986). Application of the cognitive paradigm can help shed light on why this effect is inconsistently reported. By examining students' thinking, it can be determined whether: the teachers conveyed their expectations to the students; the students perceived the teachers' expectations; the students tried to change their behavior based on their perceptions; the students were able to change their behaviors; or their achievement then changed in response to their altered cognitive and affective processes. If these conditions did exist, then the self-fulfilling prophecy will be observed. This finding implies that some students in a classroom will manifest this effect and others will not. This finding also has implications for the definition of the research topic, the choice of a dependent variable, the aggregation of data, and the interpretation of the results.

Clark and Peterson's literature review on teacher thought processes (1986) includes the topics of: planning, decision-making, judgment, implicit theories, expectations, and attributions. They further categorize research on teacher thinking as: teacher planning, teachers' interactive thoughts and decisions,

and teachers' theories and beliefs. Using the cognitive paradigm, researchers have attempted to describe the thinking that teachers do while interacting with students in the classroom. They ask the important question: Do teachers who are "effective" in producing positive gains in student achievement differ in their patterns of interactive decision-making from teachers who are "less effective" in promoting student achievement? This definition of a researchable topic is very different from asking if the number of times that a teacher performs a specific behavior (e.g., uses positive reinforcement) will affect achievement.

Methodological Implications. Use of the cognitive paradigm has implications for the importance of the subject-matter content in the teaching activity being studied, the level and type of teachers' and students' knowledge, the design of the study, the choice of a dependent variable, and the data collection method. Cognitive researchers have expressed a need for more consideration of the subject-matter content in the teaching activity being studied (Clark & Peterson, 1986; Peterson, 1988; Shulman, 1986). Peterson (1988) argues that students will use not only general knowledge of strategies for learning and acquiring information during classroom instruction but also content-specific knowledge of strategies, to enable them to learn specific subject matter content. Teachers need to have both knowledge of the general cognitive processes as well as the content-specific processes through which knowledge acquisition may be facilitated through teaching.

Process-product researchers rely heavily on standardized tests as dependent variables to indicate student learning. However, cognitive researchers (Shavelson, Webb & Burstein, 1986; Shulman, 1986) view these tests as inappropriate outcome measures because they lack sensitivity to the actual teaching-learning unit under study. Standardized tests are strictly summative; thus they miss the kinds of questions that students can answer, the kinds of mistakes they make, and the cognitive strategy they use. Shavelson et al. (1986) recommend that as an alternative, researchers should look at student-response patterns and strategies that students use to approach the test. Also, aggregating scores across students will hide

important within-class variations. Therefore, researchers should look at distributions of class performance or study subgroups. Conducting a multilevel analysis combined with theory-guided interpretations will help to clarify what appear to be inconsistencies. What the test is expected to measure and how the test data are used are the central issues in improving measurement in teacher effectiveness research.

Cognitive studies in classrooms often use student and teacher interviews to describe their mental processes (Peterson, 1988). Cognitive and meta-cognitive knowledge can be obtained through interviews, thus providing insight into teachers' self-awareness of the mental processes that they use in the classroom. Clark and Peterson (1986) describe a method known as "stimulated recall," which consists of replaying a videotape or audiotape of a teaching episode to enable the viewer (either the teacher or the student) to recollect and report on his or her thoughts and decisions during the teaching episode. Variations in the use of stimulated recall include replaying only researcher-selected portions of the recording versus replaying the complete tape; researchers asking pre-specified questions each time the tape is stopped versus soliciting open-ended commentary from the viewer; and researcher control of when to stop the tape versus viewer control or shared control. Viewer comments about thoughts and decisions during the lesson are audiotaped, transcribed, and subjected to content analysis.

Peterson and her colleagues (Peterson & Swing, 1982; Peterson, Swing, Braverman & Buss, 1982) used the stimulated recall method with fifth and sixth grade students in a math lesson on probability. Students were shown a videotape and were asked: During the math lesson, did you understand the part of the lesson you just saw on the videotape? They were also shown a copy of their seatwork problems and asked to talk about problems they did or did not understand. Independent of student ability, student reports of understanding (i.e., an ability to make a judgment about their understanding) was positively and significantly related to the number of seatwork problems they did correctly.

In a later study, stimulated recall was again used with fifth and sixth grade students in a math lesson on measurement (Peterson, Swing, Stark, & Waas, 1984). Students who could explain why they did not understand a problem or part of a lesson had higher scores.

Although not used extensively (yet) in deafness research, Deborah Clark (1985) did use this method to study deaf adolescents' meta-cognitive knowledge of reading. She found that the students, whether strong or weak as readers, had the rudiments of meta-cognitive awareness of all reading areas studied and found that deaf and hearing readers demonstrated similarity in that regard.

The exciting part of the Peterson et al. studies is that, rather than finding that I.Q. or S.E.S. predict achievement, cognitive paradign researchers are identifying process variables that might be more amenable to manipulation. Again, Peterson and her colleagues tested this hypothesis (Peterson, Swing, & Stoiber, 1986; Swing, Stoiber & Peterson, 1988). Fourth grade math teachers were taught teaching techniques for the following thinking skills: defining, describing, comparing, thinking of reasons, and summarizing. For six months, teachers in the experimental group used a 50-page manual that gave them definitions, concrete examples, and teaching ideas for each skill. Peterson et al. analyzed the data both between and within classes. They found stronger effects within classes and these appeared as ability-by-treatment interactions. In other words, the lower ability children in the experimental classes improved more in their math skills than did higher-ability children.

In order to determine why this result happened, the researchers interviewed 12 children in each class. Children were asked to solve "out loud" a problem that asked how many vans would be needed to take 29 students on a field trip if each van could hold 8 students. Based on a content analysis of protocol data, the low ability students in the experimental group used several cognitive strategies and thinking skills (e.g., thinking of reasons, defining, describing) and were able to solve the problem successfully. The low ability children in the control group showed little strategic thinking and they got the wrong answer.

Attempts have been made to teach thinking skills to deaf students using the Instrumental Enrichment program developed by Feuerstein (1980). Martin and Jonas (1986) studied the effects of teaching such cognitive skills as comparison, analysis, classification, meta-cognition, and application of skills to subject matter to deaf adolescents in a two-year program. Martin and Jonas used scores from standardized tests, including the Raven's Progressive Matrices Test and the Stanford Achievement Test (in reading and math) to measure student outcomes. They also used problem-solving interviews which required the students to respond to a hypothetical situation. Their responses were scored based on evidence of planning behavior, problem-identification ability, skill in dividing a problem into its components, and understanding of cause-and-effect relationships. Teachers were asked to rate the students' cognitive behaviors before and after training in the thinking skills. Martin and Jonas reported significant improvement on all dependent measures. These results were replicated in a study by Craig (1987) in another school, using the same approaches with similar methods of assessment. Martin (1987) also applied the program to college-age hearing-impaired students and again found significant improvement on standardized tests of intelligence, reading, and math. However, locally-developed measures of reading and writing skills did not evince a significant effect.

Implications for Deaf Education Research

Thus, although researchers in deaf education do research on cognitive topics (Martin, 1985), they have yet to fully apply the cognitive paradigm to the design of their research on teacher effectiveness. What are the implications of applying this model to research on teaching in deaf education?

No matter what paradigm is used to guide research in deaf education, the situation is fraught with complexity. Deaf students can vary on the same dimensions as hearing students (e.g., sex, I.Q., S.E.S.) and on a multitude of other variables. Mertens (in press) reviewed literature concerning school outcomes for

deaf students and categorized those variables uniquely associated with hearing-impaired subjects as follows:

1. Family background characteristics (e.g., hearing status of parents; communication mode used in the home)
2. Subject background characteristics (e.g., age of hearing loss, cause of loss, communicative skills, degree of loss, presence of additional handicaps)
3. School or school district conditions (e.g., size of hearing-impaired student enrollment, expenditure for hearing-impaired programs, support services provided)
4. Within school conditions (e.g., hearing-impaired student-teacher ratio, process of making student placement decisions)
5. Instructional personnel characteristics (e.g., signing ability, training and experience in working with deaf students)
6. Student attitudes (e.g., impulsivity, attitude toward communication, internal/external control)
7. Student placement (e.g., residential school, day school with self-contained classes, mainstreamed classes)
8. Instructional personnel performance by both teachers and interpreters (e.g., sign mode used)
9. Family support variables (e.g., adaptation to deafness, family involvement/interaction, expectations).

Thus, the researcher in deaf education must realize that the word "deaf" covers a very heterogeneous population, and therefore all reports of cognitive research must make clear exactly the characteristics of both the subjects and the context. The heterogeneity of the population, coupled with the qualitative nature of the data that results from applying the cognitive paradigm, raises the issue of the generalizability of the results of such investigations.

Lincoln and Guba (1986) contend that the traditional requirements of sound procedures for true experimental designs do not apply to qualitative research design. Criteria that are developed from conventional axioms and are rationally quite appropriate to conventional studies may be quite inappropriate and even irrelevant to qualitative studies. Lincoln and Guba (1985) devised criteria for qualitative research that parallel those of the conventional paradigm. Instead of generalizability (or external validity), they recommend transferability as a qualitative analog. Transferability can be determined if the researcher provides "thick description," i.e., a narrative developed about the context so that judgments about the degree of fit or similarity may be made by others who may wish to apply all or part of the findings elsewhere.

A second issue in applying the cognitive paradigm in deaf education arises from the unique mechanism by which information is conveyed to the deaf student. According to Woodward, Allen and Schildroth (1985), the majority of hearing-impaired students and their teachers in mainstreamed classrooms communicate primarily through an interpreter. Thus, the researcher is faced not with the teacher-student dyad as in traditional "hearing" research, but with a triad of teacher-interpreter-student. Thus, complications arise concerning the method of collecting data. For example, if the stimulated recall method were used, the researcher would need to videotape the teacher, the interpreter, and the student. This procedure might be carried out by having one camera on the teacher and another on the interpreter-student dyad.

If valid data could be obtained by such a process, the researcher is then left with several other problems. For example, how does the researcher prepare transcripts of the videotaped material which consists of a combination of spoken and signed language? Cognitive researchers could borrow a technique developed by anthropologists and linguists to solve this problem. Klima and Bellugi (1979) developed a transcription system that was modified by Erting (1982) to code signed videotapes. Erting's system allows

the transcription of non-manual behavior, the signing behavior of both hands separately, voice transcription,

English translation where appropriate, and contextual information. This is a very labor-intensive and time-consuming process. Thus, the questions of sample size and number of observations become even more critical.

Notwithstanding Lincoln and Guba's (1985) call for "thick description," small sample sizes, lack of comparison groups, and limitations on the number of observations (simply for logistical purposes--to keep the data set "manageable") flies in the face of the traditional experimental model of research. If researchers in deaf education choose to apply the cognitive model to their complex problems, they will be faced with an up-hill battle to convince funding agencies that this is a legitimate approach. Both the federal Office for Educational Research and Improvement (Kilgore, 1986) and the National Science Foundation (Tressel, 1987) continue to include the criteria of generalizability and comparison groups as a basis for awarding funds.

If research funds can be obtained and data collected and coded, the researcher is then left with the difficult task of interpreting the results. Suppose that the student does not understand what the teacher is trying to convey. Is the problem in the way that the teacher chooses to communicate the message, the way the interpreter translates the message to the student, or in the cognitive or meta-cognitive processing by the student? If feedback is given to the teacher and interpreter as to the student's perception of the content of the message, will that action lead to a change in their behavior that will result in greater understanding by the student?

Leading educational researchers hypothesize that providing feedback to teachers about their students' thinking may well be the avenue to true improvement in teaching outcomes (Brophy & Good, 1986; Cazden, 1986; Shulman, 1986). Shulman (1986) stated that "...the most useful kind of feedback to

give teachers who have participated in research on discourse in their classrooms may well be accounts of what their pupils were doing, saying, thinking, and feeling, rather than detailed analyses of their own behavior. The portrayal of pupil responses to teaching may be more productive of positive changes in the teachers and less likely to breed defensiveness and denial, than would descriptions of the teachers themselves. It is a researchable point and one worth taking seriously" (p. 22).

Implications for Future Research

Application of the cognitive paradigm to research on teacher effectiveness in deaf education also has implications for the way researchers define the research problem, design their studies, and analyze and interpret their results.

Definition of Topic

Researchers will need to formulate questions regarding what the teacher knows, what the students know, how the students mediate the information received from the teacher, and what impact this mediation has on performance (Weinstein & Mayer, 1986).

Subject Matter Content

Increased attention will need to be given to the subject matter that is being studied (Shulman, 1986; Peterson, 1988). Martin (1987) started in this direction by training English teachers to design instructional activities within their own discipline that could be used to teach generic thinking skills. Peterson (1988) contends that there are content-specific thinking skills that are important to the mediation of information between teacher and student. Emphasis on content-specific thinking skills along with general thinking skills embedded within a specific content area will require researchers to establish more collaborative relationships with the relevant content experts.

Choice of a Dependent Measure

Leaders in cognitive research have warned against the use of standardized tests as dependent measures (Shavelson, Webb & Burstein, 1986; Shavelson, 1986). Instead researchers should look at student response patterns and strategies used to approach problem solving. Performance data should be tied closely to the subject matter which was taught. This connection presents a logistical problem in applying this concept to deafness research because frequently the number of deaf students in a class is very small. If data are collected from several classrooms, the teacher-made tests of performance may not be appropriate across classrooms. As Martin (in press) pointed out, development of appropriate assessment techniques is one of the great challenges facing researchers in the coming decade.

Method of Data Collection and Analysis

Interviews are frequently used in cognitive research to access the mental processes of students and teachers (Clark & Peterson, 1986; Peterson, 1988). The stimulated-recall method has been shown to be a very effective method of obtaining in-depth information about thought processes. This method presents logistical problems in deafness research because two cameras would be required to record the activities of the teacher, student, and interpreter. Coding, analysis, and interpretation of the information would require excellent understanding of sign language and would be very time-consuming. This change has implications for sample size, resources required, and number of observations that are feasible.

Analysis by sub-groups is recommended in cognitive research (Shulman, 1988). In deafness research, the multiplicity of variables that must be considered adds to the complexity of this task (Mertens, in press). Lincoln and Guba's (1985) advice concerning "thick description" would be well heeded by researchers in deafness to make clear exactly the type of subjects who are in the study and, thus, aid in the transferability of results.

Adopting the Cognitive Paradigm

Movement from the traditional experimental research model to the cognitive approach to research will require researchers in deafness to adapt more than their research methods. This shift has political and economic implications as well. As long as funding agencies continue to insist on generalizability, large samples, and comparison groups, it will be difficult to obtain support for research based on the cognitive paradigm. However, as Shulman (1986) pointed out, providing feedback to teachers about their pupils' thinking may be the most useful way to produce positive changes in teachers and in student learning. This is an empirical question and the work of the leaders in the educational research field suggests that this is a promising way to bring about the changes in educational practice and outcomes that we seek.

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